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How positive is "change" in climate change? A sentiment analysis

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ABSTRACT

This paper describes the results of a non-computational sentiment analysis of the word 'change' on the subject of climate change, local climate innovation and development path change. Results were obtained from interviews conducted with local government officials in 11 communities across British Columbia: Victoria, Vancouver, Prince George, Dawson Creek, North Vancouver, Campbell River, Revelstoke, Surrey, T'Sou-ke First Nation, West Vancouver, and the Kootenay Regional Districts. The sentiment analysis was undertaken to address the lack of agreement among climate researchers and policy-makers over the meaning of change, and to determine whether changes were actually occurring in their development paths. As a result, several drivers and barriers to change were identified at the local government level. Staff quality and horizontal integration were linked to the most positive sentiments, whereas barriers to behavioral change and the limited pace and scale of change were associated with negative sentiments.

1. Introduction

COP 21 ended with an unanticipated outcome of nation states achieving consensus on an ambitious and bold goal of holding the increase in the global average temperature to well below 2 °C above pre-industrial levels (UNFCCC, 2015). Since that time there has been a disconnect between Canada's nationally determined contributions and the ongoing efforts to achieve that target, revealing that it was largely aspirational, with major implementation barriers (CAT, 2018). If nation states are serious about reaching that target, it is clear that we must move from business-as-usual scenarios to transformative change in current development paths (more available in IPCC, 2007; Moore et al., 2018).

This disconnect—between the consensus on one hand, and the implementation of changes needed to reach the goal on another—also reveals a more general confusion regarding the language of change. A persistent challenge to transition from awareness and concern to action remains (Moser, 2016), as well as understanding the nature of change in current development paths. This research focuses on changes taking place in each of the assessed communities that are related to climate and the transition from their current development trajectories. The need to achieve a rather radical transition to address the threat to socio-ecological systems posed by climate change (Foxon et al., 2009; Moore et al., 2018) is well known. In fact the latest IPCC Special Report (IPCC, 2018) approved by governments and involving 91 authors from 40 countries, clearly states that to reduce the risks associated with long-lasting or irreversible changes, limiting global warming to 1.5 °C compared to 2 °C would require rapid, far-reaching and unprecedented changes in all aspects of society.

In spite of a global agreement on the need for change, this 'change' will undoubtedly look different in every community; its urgency, cost, consequences, and lifespan will not necessarily align. Plans for change, from small-scale to transformative, will also inevitably face complex barriers. Yet continuing climate science, uncertainty about natural resource limits, and ongoing conflicts over resource developments make it clear that we need to examine our current development paths and reframe the conversations on how to change their trajectories. We believe that we are now at a stage that the world needs "transformations of a scope, magnitude, speed, and penetration that are unprecedented in human history" (O'Brien, 2015: 1170).

This paper addresses what we have found to be a prerequisite for implementing and calibrating transformative change, which is namely reflection and dialogue on 'change' among those who are fighting for its institutional inclusion and acceleration. The analysis of the debate about change includes the drivers and barriers to change, past successes and innovations, and adaptation and mitigation measures put in place by varying levels of government and/or organizations.

The research literature on the environment (e.g., Scharl et al., 2015; Sluban et al., 2014, 2015; Weichselbraun et al., 2016) and more specifically on climate change change (e.g., Cody et al., 2015; Fernandez et al., 2016; Hodson et al., 2018; Holmberg and Hellsten, 2014) using sentiment analysis or opinion mining, especially in the Canadian

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context, is rather small, in part because such analyses are a relatively recent phenomenon. Additionally, besides analyzing the methodology employed for the sentiment analysis per se, most research on environmental or climate change sentiment is focused on exploring communication, from patterns to its causes and effects. There is, however, no previous work available on the use of sentiment analysis on change for elucidating the successful and failing efforts, the drivers and barriers to change in current development paths from the perspective of local municipalities. Nonetheless, a number of studies have assessed the role and the manner in which local governments in Canada and more specifically in British Columbia are introducing climate-related measures and changes in their planning and implementation efforts (Baynham and Stevens, 2014; Burch, 2010; Burch et al., 2014; Dale et al., 2017; Drolet, 2012; Giest and Howlett, 2013; Newell and Robinson, 2018; Moore et al., 2018; Picketts et al., 2014; Shaw et al., 2014).

In what follows, we describe the results from a six- year longitudinal research project, *MC3: Meeting the Climate Change Challenge*, which explores climate innovation in eleven Canadian local municipalities. Using interviews from across British Columbia, Canada, over two phases of the MC3 project (coinciding with multiple political administrations), the present analysis looks to the uses of the word 'change' in order to create a map of real-life change (and drivers and barriers to change) on the ground. Though each community faces vastly different challenges when it comes to implementing change, we can trace from this map the commonalities that ought to be studied in order for Canada to move towards its target at a larger and faster scale. Detailed observations on what has worked and what has not worked from the perspective of local municipalities are outlined below.

2. Methodology

This study used a mixed-methods multiple case study approach (Yin, 2003), since the purpose of this research was to conduct an empirical analysis of a contemporary phenomenon within its real-life context, in this case individual perspectives on the concept of change.

2.1. Case selection criteria

Case selection followed a purposive information-oriented sampling; using prospective criteria, cases were selected for both sharing some similar characteristics and relevant contrasting background to enrich the discussion with a diverse range of outcomes. Two primary criteria structured the initial selection of case studies and informed the interview protocol.

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1 Communities were selected that exhibited leadership on adaptation, mitigation, integrated adaptation/mitigation approaches, and sustainability. Examples of particularly innovative action that had either transformed emissions pathways and/or vulnerability or held significant promise to do so in the future were chosen.
2 Evidence of multi-stakeholder involvement and social learning. The scale of the cases was not limited to municipal governments, thus opening up the possibility of studying compelling action at a regional scale. We selected cases where action at one scale had been taken up by, or was of direct relevance to, other scales.

In addition, secondary selection criteria were incorporated to capture a variety of communities demonstrating notable and diverse efforts to address climate change. The following secondary criteria were included: 1) a mix of small, medium and large communities; 2) a mix of rural and urban; 3) communities with a long history of climate change action and emerging leaders; 4) a mix of resource- based and diversified economies; 5) a mix of government-led and grass-roots approaches; 6) generalizability or relevance to other communities; and 7) evidence of social mobilization as a component of action.

After meeting these criteria, the final selection of communities was completed in close collaboration with a diverse array of civil society and government research partners. The eleven case study communities were the cities of Victoria, Vancouver, Prince George, Dawson Creek, North Vancouver, Campbell River, Revelstoke, and Surrey, together with T'Sou-ke First Nation, West Vancouver district municipality, and the Kootenay Regional Districts (detailed description: mc-3.ca/case-studies). To ensure the relative comparability of the case studies and robustness of analysis and findings, a comparative five-step approach detailed in Shaw et al. (2014) was undertaken.

In the second stage, critical case sampling was employed for the selection of three key informants per case study community to conduct semi-structured interviews, with the exception of the T'Souke first Nation where only one key interviewee was available. The total 31 key actors -mostly local government officials (ranging from chief administrative officers and city managers to city staff and councilors) and official community representatives directly involved in the design and implementation of climate change initiatives- were selected within a subsample of participants from the first phase of MC3, 2012 to 2015 (Newell and Dale, 2015; Shaw et al., 2014; www.mc-3.ca).

2.2. Data collection and analysis

The interviews were carried out using an open-ended, semi-structured interview protocol that drew upon three theoretical lenses - multi-level perspectives, social practice theory, and social-ecological systems (see Moore et al., 2018). Guiding questions (15–25) were formulated to determine the nature and degree of change that has occurred in the case study communities since 2012 and the way these changes including climate change innovations were shifting the way communities developed over time. Interviewees were told in advance that their responses would remain confidential, and their colleagues would not be aware of their participation in the study. These interviews which lasted from 30 to 60 min, were audio recorded and transcribed with permission of the participants. Since our present analysis focuses on the use and context of specific language, we adapted elements from the computational method of text mining in order to narrow down the body of text to passages containing the word "change." Using the computer software NVivo (v11), search queries were built for the relevant codes, comprised of words associated with the code, and included word derivations and stemmed words.

Next, we applied sentiment analysis to sort the excerpts into positive or negative groupings. Opinion mining or sentiment analysis, used interchangeably (Kennedy, 2012; Pang and Lee, 2008; Thelwall et al., 2011), refers to the analysis of the explicit or implicit expression—in this case lexical—of a person to determine their attitude with respect to a topic. As in Kim and Hovy (2004), there were four evident points of classification: the attitude holder, the target object or aspect, the claim, and the attitude. The attitude holder is the interviewee linked to a specific case study community. The target object is "change" related to climate and the transition to a new development path. The claims are the different topics, grouped into results and discussions as externally and internally driven changes and their subdivisions, on the subject of or concerning the target "change". The attitude is the orientation of the claim, being positive or negative sentiments. After removing the inapplicable excerpts and the excerpts lacking a distinct sentiment to improve performance of the analysis (Pang and Lee, 2008), the remaining sentiments were identified and classified according to their polarity.

Natural language processing (NLP) or computational linguistics are, due to the rise of social media and the web 2.0, widely employed to systematically identify the polarity of a given text. Nevertheless, computer systems and NLP are not robust enough to generate accurate semantic representation of text (Aggarwal and Zhai, 2012). Although the level of inter-human disagreement on sentiment classification can be as high as 20% (Ogneva, 2010), this is considered to be the maximum

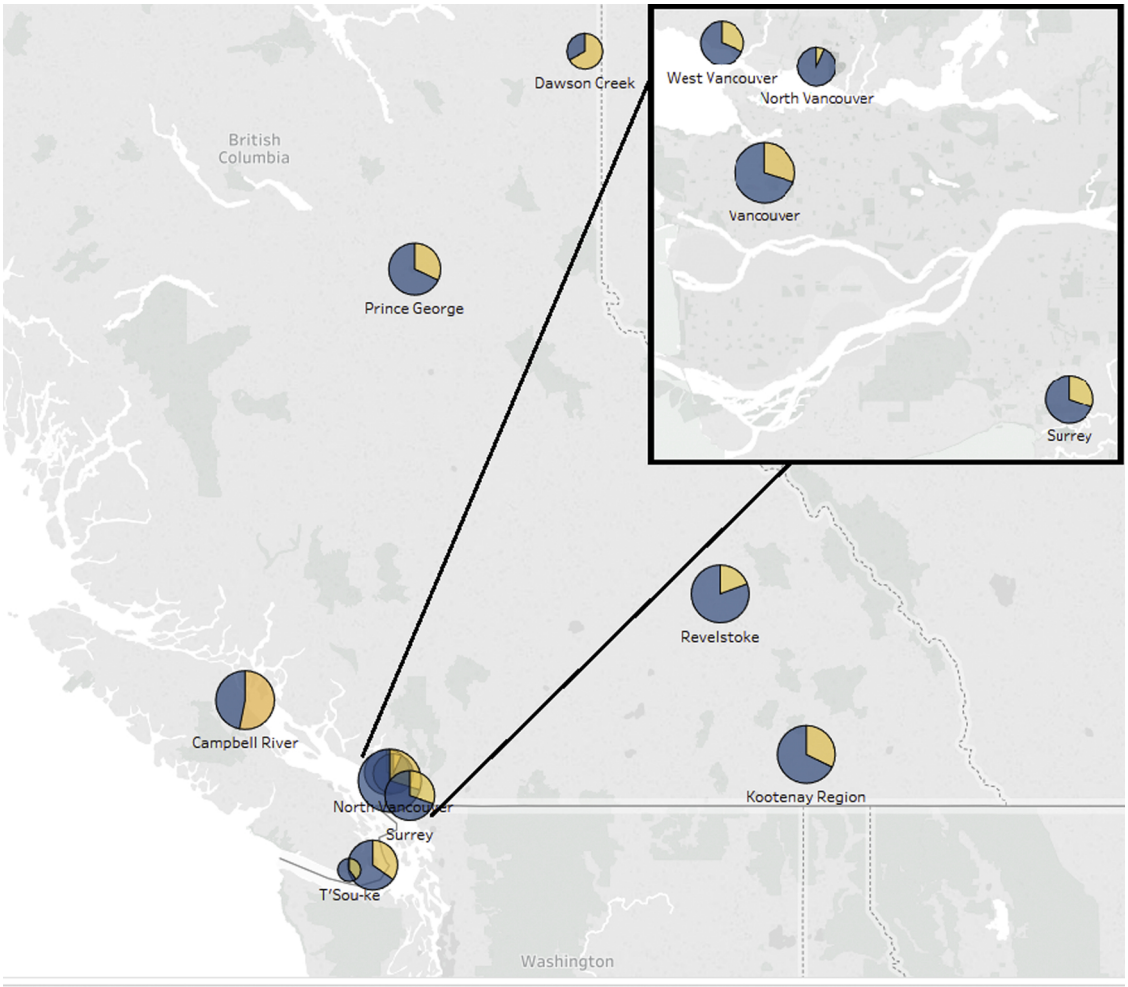


Fig. 1. Location and distribution of sentiments on change. (Blue, positive sentiments; Yellow, negative sentiments).

accuracy that sentiment classifiers based on machine learning can reach (Mozetič et al., 2016). In an effort to achieve the highest accuracy, while taking advantage of our relatively small corpus, this research used human classification. Two separate researchers completed the analysis with almost exact consistency. The following section provides detailed examples from the results as well as data visualizations.

3. Results

Following Kim and Hovy's (2004) points of classification, the results (and the following discussion) focuses on the attitudes found in relation to the different claims or issues concerning the aspect of changes in climate or in development path. As topics around these changes varied considerably, with some very case specific or even considered as anecdotal evidence, the outcomes were assorted and summed up in 8 topics and 6 subtopics. The number of positive sentiments expressed regarding change was almost double the negative ones. Fig. 1 shows how these attitudes are distributed along the different communities. As illustrated, only two communities out of 11, namely Campbell River and Dawson Creek, have a higher number of negative sentiments than positives.

Fig. 2 shows the results obtained for the 12 most relevant topics, which are later interpreted in detail in the discussions section. As illustrated, only one topic presented more negative sentiments than positive. Facing the increased risks of negative impacts of climate change, most interviewees related the observed and projected changes in nature with negative sentiments.

In addition, from the analysis, and as portrayed in Fig. 2, interviewees expressed a similar amount of negative and positive sentiments regarding change in relation to only two topics: mitigation measures taken by the local government and the framing of climate change. In the first case, the negative sentiments reflected the discontent of respondents due to the limited extent and pace of local implementation efforts (insufficient change). In the second case, the negative sentiments were related to changes in the climate change narrative, where interviewees argued that community members are less keen to engage in discussions involving climate change rhetoric. Respondents mentioned that local government tends to shift the manner of framing climate change by addressing related issues, such as adjacent concerns or co-benefits, more relevant to community members.

Positive sentiments by official community representatives and local government officials concerning changes in 10 out of the 12 major topics (claims) where superior or highly superior to their opposed attitude (negative sentiments). To avoid reiteration with Fig. 2, the reader is referred to the discussions section for a detailed description and analysis of these outcomes. Battery signs placed next to each of the main topics in the discussions section are intended to visually remind the reader with the proportion of negative sentiments (in red) and positive sentiments (in green) vis-à-vis change regarding that topic.

4. Discussions

Although climate change remains a contested connotation nationally and internationally (Stoddart et al., 2016), this negativity has

Fig. 2. Outcomes of the sentiment analysis on climate change relevant topics. ◇ Positive sentiments; ✕ Negative sentiments.

decreased in recent years, these results show an overall higher number of positive sentiments surrounding change. This higher concentration is likely due to the fact that many of the interviewees' duties involved trying to introduce changes in their present organizations. Thus, changes taking place in the local government or municipalities are, more often than not, regarded by interviewees with tacit enthusiasm and positivity.

4.1. Externally-driven changes

4.1.1. Changes in natural environment

Seven case studies in this research have marine-terrestrial interface ecosystems, considered to be highly vulnerable to climate change impacts (Price and Daust, 2016), from sea-level rise to more frequent extreme events such as tsunamis. Changes impacting the natural environment were mentioned throughout the interviews with special concern for coastal storms affecting coastal wetlands. In addition, there were frequent negative references to increases in forest fires, flooding, and the increased presence of non-native invasive species impacting the fragmented ecosystems as a consequence of climate change. Nevertheless, there were positive sentiments related to changes in nature in Victoria. These were linked to increased observations of marine mammals, probably due to their heightened presence (Ford, 2014).

Mixed attitudes were also present regarding the perception of mitigation and adaptation measures taking place in the aftermath of climate-related disasters. Positive sentiments were connected to increased awareness, media coverage, and opportunities to benefit from this enhanced awareness. In fact, extreme events often serve as a stimulus for governments, motivating adaptation and mitigation planning (Füssel, 2007; Hamin, 2011).Whereas negative sentiments were focused on the impermanence of the increased awareness, as well as the observed belittlement (coming from community members and local government) of the need for urgent measures, due to the belief that risks are longer-term and carry higher levels of uncertainty. As Baynham and Stevens (2014) stated, long-term gradual changes in climatic conditions act opposed to fast-onset events, producing a weaker reaction from governments, as they are not affected by an initial impact. This allows elected officials to focus their efforts on concrete and tangible short term priorities (Vogel and Henstra, 2015), which are more closely aligned with their personal objectives during their term of office and electoral cycle short time frames.

Another negative sentiment reported in Campbell River was the conflicting trade-off between climate action and the biodiversity agenda, especially apparent in communities with more limited resources. While the increased attention on climate change issues tends to divert from efforts to support endangered wildlife, biodiversity is just as urgent (Favaro et al., 2014; e-Dialogue series, 2018).

4.2. Internally-driven changes

4.2.1. Integration of the climate change agenda and intra-organizational collaboration

Climate policy integration is defined here as the incorporation of the aims of climate change adaptation and mitigation into other policy sectors, both environmental and non-environmental (Beck et al., 2009; Dupont, 2010; Lafferty and Hovden, 2003). To enhance policy coherence, efforts to entrench as an overarching lens or mainstream a particular social value such as sustainability or climate change principles should become institutionalized in decision-making processes (Kok and de Coninck, 2007; Vogel and Henstra, 2015).

Whether on an operational or a strategic level, changes regarding the integration of climate change or sustainability initiatives in local governments were considered positive by all interviewees. Integration improves coordination across or between sectors, and thus renders services more efficient and effective (Cowell and Martin, 2003). Outcomes of the present research corroborated this for the most populated cities, where there are greater risks in larger organizations of fragmented or excessively entrenched silos. Representatives from the larger municipalities, including Surrey, Victoria, Vancouver, and West Vancouver, praised the collaborative approach: "The intent is to have an

integrated model where sustainability is a core duty and responsibility for everybody, rather than a department" (I1, City of Victoria, telephone interview, 2015). Similarly, it was important for a representative in Revelstoke that the decision-making process related to climate change not be relegated to a separate corporate function. These sentiments align with research showing that climate change and sustainable development policies are relevant to most, if not all, departments (Yohe et al., 2007). Combining departmental initiatives with, for example, sustainability measures, has a greater effect than if implemented separately (Dale et al., 2017).

It is worth noting as well that it was deemed critical for smaller (i.e. population below 50,000) local governments, faced with more limited resources, to have the help of an external expert in assisting with climate change and sustainability issues, and with raising awareness.

4.2.2. Changes in leadership and staff champions

4.2.2.1. Federal and provincial governments. Four local governments (Campbell River, Vancouver, West Vancouver, and Revelstoke) emphasized the importance of increased alignment with the federal and provincial governments. Cross-scale interdependencies, namely the federal, provincial, and local governments, tend not to be well integrated (Adger et al., 2005; Drolet, 2012). During the first and most of the second phase of our research (2012–2018), provincial and local governments showed greater willingness to engage in climate change efforts than the federal government (Giest and Howlett, 2013). One of the biggest drawbacks for the federal government to maintain a leadership role, as stated by Doelle (2018), was the failure to position the Pan Canadian Framework on Climate Change as a first step that needed to be gradually strengthened. Instead, the federal government has taken backward steps in response to political opposition and pressure from industry sectors (Doelle, 2018). Yet multi-level governance is critical to coordinate policy- making across all levels (Bauer et al., 2012; Dale et al., 2017), in order to accelerate the adoption of local innovations and to address asymmetries of scale. There is increasing pressure on local governments for more leadership and accelerated adoption of climate innovation. Previous studies, for example, show that pressure from higher levels of government, such as top-down directives through state or provincial mandates, provide local governments with motivation critical to implement strong measures for addressing climate change (Berke et al., 1996; Homsy and Warner, 2013; Tang et al., 2010).

4.2.2.2. Local government and their staff. The presence of strong leadership, both technical and political, has been identified by Burch (2010) as a key resource and crucial enabler of action on climate change, following a study in three municipalities in British Columbia. Positive sentiments regarding changes in the local government were mentioned regarding the staff number and their mindset towards climate action. For example, in Campbell River the higher commitment to fighting climate change since 2014 has been praised by a respondent who considered it as very positive for boosting morale among the city staff, enhancing innovation, creativity, commitment, and productivity. Similarly, a Victoria representative asserted that political leadership was critical for advancing climate-related changes. Positive changes in the number of staff working on sustainability, environment, and energy management were also reported, respectively, by interviewees from the cities of Vancouver, Prince George, and Revelstoke. A study on the incorporation of climate change adaptation in Prince George's community planning (Picketts et al., 2014), underlined the strength in the city staff social capital, across different sectors including planners engineers and managers. Picketts et al. (2014) stated that their previous experience and know-how was a driver, since they were able to introduce climate-related measures after independently proposing climate-relevant policies.

On the negative side, the leadership changes in Dawson Creek were deemed by a respondent as detrimental to climate innovation. The new council and mayor were reported to be major oil and gas pushers and climate change deniers, in contrast to their predecessors. In spite of this, some of the new staff in the planning department were deemed to have passion for and interest in sustainability.

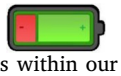
4.2.3. Changes in strategic planning

One of the most praised and positive change cited by interviewees was the signing of the Climate Action Charter by local governments and their subsequent commitment to reducing GHG emissions and taking actions around climate change. This was clearly expressed in 8 out of the 11 case studies (Kootenay Regional Districts, Campbell River, North Vancouver, Prince George, Revelstoke, Surrey, Vancouver, West Vancouver), which did not mean that it was not also shared in the remaining cases. As a result of Bill 27 amendments in 2008, local governments were required to integrate in their official community plans (OCP) GHG emission reduction targets, together with actions and policies for achieving those targets (Rutherford, 2009). Working as a "planning mandate", it greatly increased the likelihood for governments to achieve their planning outcomes (Baynham and Stevens, 2014).

As a matter of fact, respondents mentioned that introducing these policies and measures as part of their official community plans (OCP) or sustainability plans (e.g., ICSP) was a major positive change for moving forward. By incorporating climate-related mid- and long-term goals, the Charter provided a framework within which developers and the municipalities could target actions and assess development plans by filtering them first through climate or sustainability lenses. As stated by Kootenay Regional Districts, the Charter also expanded the focus from providing basic infrastructure to a perspective of community well-being, including heritage, culture, and recreation.

The Charter requirements also led to increased innovation in several cases. Respondents from Vancouver and West Vancouver mentioned that the need for more innovative approaches influenced them to work more collaboratively, by bringing more executive people on board and ensuring full support within teams. Participation of non-state stakeholders helps ensure more effective implementation and provides an enriching, area-specific, policy-relevant knowledge and experience (Bauer et al., 2012; Agrawala and Fankhauser, 2008). In addition, the commitment to monitoring and reporting GHG emissions had forced local governments to keep track of and reduce their levels of energy consumption, described by several respondents as a positive measure. Monitoring was also mentioned as a positive change, e.g., to better target their actions (Revelstoke), or for refining target groups for housing projects (Vancouver). However, for smaller municipalities with tighter budgets e.g., the Kootenay Regional Districts, changes prompted by the Charter were also negatively associated with increased management costs required to comply with the monitoring and reporting activities.

4.2.4. Measures implemented



A high ratio of responses within our analysis were focused on the measures taken by local governments to target climate change and sustainability issues directly or indirectly. This should not come as a surprise, as local governments are not only directly affected by climate change impacts but also have a substantial influence over future GHG reductions, thus locally implementing climate actions is in their best interests (Baynham and Stevens, 2014).

Measures such as the development of urban agriculture or community gardens, where the main emphasis is on food security, were described to positively influence community members by making them more aware of their environment and more active in creating networks. Survey findings from an alternative study on B.C. communities including Prince George (Drolet, 2012) showed that respondents were eager to support and encourage local food production. These practices

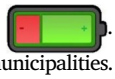
were said to contribute to building stronger and more cohesive communities (Drolet, 2012). Further positive changes were mentioned in Kootenay Regional Districts, West Vancouver, Revelstoke, and Surrey in relation to solid waste management initiatives, including both organics and recycling programs, due to increased awareness among users and the fact that they were now achieving their waste diversion goals while reducing impacts on climate change (Ackerman, 2000). In the Kootenay Regional Districts, the creation of a reserve fund to offset their corporate emissions was described as a positive change.

4.2.4.1. Mitigation measures . Overall, respondents regarded municipal and community mitigation efforts as positive, yet turned to negative sentiments to address gaps in the current efforts. For example, a West Vancouver interviewee spoke negatively about the absence of progress in monitoring or reporting on community- level GHG emissions—an action that was already implemented at the corporate level. They believed that implementing this at the community level would also encourage private enterprises and would boost overall mitigation efforts.

Regarding mitigation efforts, many spoke optimistically about changes in the transportation sector. For example, three municipalities in the Kootenay Regional District were supporting the measurement and analysis of vehicle emissions by equipping their local bus fleets to provide information on GHG emissions, an action that was expected to lead to more deliberative decision-making. Regarding electric vehicles, Vancouver reported that a considerable increase in the number of charging stations.

Efforts to reduce the use of private transportation by improving car sharing and public transport services as well as supporting active transportation were considered positive changes in North Vancouver, Revelstoke, and Victoria. A respondent from Victoria added that improving infrastructure to increase the number of cyclists and pedestrians had proven to be a very successful mitigation action. In metro Vancouver, however, a recent survey revealed that whereas most residents (1/2) believed that separated bike lanes were a good thing, far fewer (1/3) wanted more in the city (Korzinski, 2018).

An additional negative sentiment involved the suburban conditions and high-growth rate prevalent in municipalities such as Surrey, which made changes in emissions reduction more challenging. Similar comments emerged for Campbell River, where the continuous efforts and initiatives made by the local government were insufficient, since the growth of the community was outpacing their implementation measures.

4.2.4.2. Changes linked to residential development  . Sentiments related to building regulations varied across municipalities. Vancouver interviewees were more concerned with this subject as buildings represent approximately 65% of the city's GHG emissions. Changes in regulations to increase energy efficiency were highlighted, although regarded with caution as, together with gentrification, there appeared to be a trade-off between the climate agenda and the affordability agenda. The former precludes lower initial costs for construction purposes, thus conflicting with the latter. It is noteworthy to mention that housing affordability was the dominant issue of recent elections for many communities in B.C., mainly in Victoria and Vancouver, both of which face the worst affordability conditions on record since the mid-1980's, with no relief in sight (Wright and Hogue, 2018).

Interviewees in Vancouver mentioned positively that the development community was open to changes, and the implementation of a future clear and longer-term government plan. Respondents from both Vancouver and West Vancouver agreed that the implementation of the building code for increasing energy efficiency in housing was something that they had the ability to enforce. Both were confident about the efforts to have new buildings built to a higher standard. Building retrofits, however, were cited as more challenging since the local governments' ability to encourage owners was more restricted. Yet in the Kootenay Regional District, the implementation of energy retrofits was considered by a respondent as successful.

Overall, improving the energy efficiency of new buildings in BC was considered by some developers and researchers as an "easy win" or low hanging fruit to address climate change. Describing green or zero emission buildings as having a great potential, even without changes in technology, and greater long term savings, covering the initial investment in 3–15 years (Bitz et al., 2016; Ruparathna et al., 2017) was regarded positively.

4.2.4.3. Adaptation measures . Additional changes focusing on adaptation and incorporated in provincial building regulations were also mentioned by interviewees. Positive changes such as sea-level rise response were mentioned by both Vancouver and North Vancouver. Following the use of models and mapping scenarios, the minimum building elevation requirement underwent a 1.1 m increase. In West Vancouver, Campbell River and Surrey, respondents encouraged changes to take advantage of coastal engineering processes as a response to flood mitigation and erosive forces from wave action. Thus, instead of building dykes higher, they were seeking more beneficial innovations such as green infrastructure or beach nourishment through offshore and barrier islands.

Faced by a different threat, Kootenay Regional District's primary concern was forest fires. Consequently, proposals for new developments required land to be mitigated to FireSmart standards prior to building a new sub-division. An additional positive change was extending the interface fire mitigation project to protect one of their drinking water treatment facilities and infrastructure.

The reduced number of outcomes regarding changes in adaptation (see Fig. 2), including the clearly lower amount of negative sentiments, might be related to the lack of requirements for adaptations targets in the BC Local Government Act, which left local jurisdictions with non-binding and broad adaptation objectives (Rutherford, 2009; Picketts et al., 2014).

4.2.5. Perception of climate change in the local government

Ambiguous or conflicting preferences and the lack of convergence among local elected officials around particular policy solutions are considered a political barrier for adopting and/or implementing climate change policy measures (Wu et al., 2018). Therefore, political will is regarded as an essential enabling condition for local climate policy development (Ford and King, 2013) and critical for policy success (Post et al., 2010). Additionally Post et al. (2010: 660) divide the concept of political will into the following four components:

1 a sufficient set of decision makers;
2 with a common understanding of a particular problem on the formal agenda;
3 is committed to supporting, and
4 a commonly perceived, potentially effective policy solution.

Following the previous, to take a course of action decision-makers ought to share a common understanding of a particular problem and its potential effective policy solutions, in this case the perception of climate change and their adaptation and mitigation measures.

Within the local government, in this analysis, climate change action was largely acknowledged to be insufficient, with a lack of will often cited as the cause for inaction. Respondents from Campbell River, Kootenay Regional Districts, Dawson Creek, North Vancouver, and Revelstoke observed that changes were still limited in scope, number, aspects covered, and pace, describing the overall landscape as a transition process that would take a long time to implement. The collected responses provide further insights about the perceived barriers and

drivers to transformative change.

One positive change was the trend to recognize climate change as a cause of natural hazards and to plan for their future consequences, as discussed by a respondent from Campbell River. In the Kootenay Regional District, however, in spite of the recognition of climate change within the local government, their lower vulnerability to its impacts and thus little concern, had led to little progress on adaptation initiatives.

The desire to implement climate actions at a faster pace without creating much chaos in the city was clearly expressed by a respondent from Vancouver. However, two barriers that limited their introduction were identified. First, the lower price of fossil fuels and their derivatives, mad the economic benefits of renewables less evident. Second, public opinion and their acceptance of change, in this case the implementation of mitigation measures, was negatively related to the pace of change.

The following examples suggest that community and intra-governmental actions result in higher reported positivity. Despite the growth pressure, positive changes within the local government in Surrey were related to the willingness and ability of different departments to influence other staff in favor of the relevance of climate change and sustainability. A respondent from the Kootenay Regional District positively mentioned that structural issues were no longer a barrier to moving forward on a more progressive agenda. Also, communities from the regional district were described as moving forward at a similar pace and sharing common goals, partially due to the regional approach they had taken and the sharing of knowledge and expertise between smaller communities as a result of this scale of collaboration.

Actions by higher levels of government had mixed sentiments. In both the Kootenay Regional District and Victoria, there were positive responses to the engagement of the provincial government, the way that they were providing guidelines and continuous feedback to the local government, and how renewed policies could support local initiatives. A respondent in Surrey considered it critical for provincial leaders to have climate change and sustainability on their agendas with the understanding that local governments are often subject to the policies and mandates created by senior levels of government. In T'Sou-ke First Nations, a respondent warned about the contradictory measures being undertaken by the provincial and federal governments in the name of national economic interest and sustainable development.

Multiple respondents (Campbell River, Victoria) identified risk as a major barrier preventing greater local government action. The fact that the negative consequences of inaction were expected to take place in the future, with little probability of natural hazards greatly affecting their term of office, made local governments more reactive rather than proactive, especially in the interior of B.C. Even if the personal desire was to take adaptation measures proactively, and take the least economically disadvantageous course, the council was unlikely to support measures that only pay-off in the longer term. However, the flipside of this was a reported positivity (in Victoria) around discussing win-win situations, arguing that by initially focusing on positive opportunities with low risks, specific actions benefiting both the economic and environmental agendas had a much higher chance of being implemented.

In Dawson Creek, changes in the way the local government was willing to engage were seen as positive, although he motivation was to capitalize on the increase in financing for green initiatives. Given that not only the city but also the majority of people in Northeast BC do not believe climate change is caused by human activities,as reported by two respondents while quoting a recent study (Mildenberger et al., 2016), having financial benefits associated with climate-related measures is key to persuading them to change.

4.2.6. *Perception of climate change among community members*

The present research also assessed community perceptions of climate change-related risks and policies. According to a 2012 study in B.C., community members do not trust the local government to effectively address climate change (Drolet, 2012). A literature review carried out by Wachinger et al. (2013), revealed that besides personal experience, the lack of trust in authorities and experts has the most substantial impact on risk perception. furthermore, a study of lack of trust in 35 countries to blunt the effect of risk perceptions on public willingness to engage in behaviors or support policies to address climate change (Smith and Mayer, 2018).

In this study, however, the analysis showed that community members were disengaged (due to lack of understanding and lack of will) or opposed to these policies. This lack of consensus among residents is a consequence of the complex and intriguing behavioral intentions regarding climate change, as people are neither complete believers or fully opposed to all personal and government efforts to adapt and reduce GHG emissions (O'Connor et al., 1999). Results regarding disengagement are well supported by previous studies stating that the lack of knowledge and low risk perceptions are a powerful predictor of behavioral intentions (e.g., Becker et al., 2013; Botzen et al., 2009; Dzialek et al., 2013; Lechowska, 2018; McDaniels et al., 1997; Semenza et al., 2008; Stern, 2000).

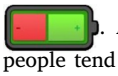
Nonetheless, most interviewees saw any effort towards involving community climate action as positive. In West Vancouver a respondent mentioned (in relation to the positive efforts of recycling) that residents want to do the right thing, and, according to a Surrey respondent, sustainability was now the norm. In North Vancouver, people were reportedly going beyond compliance of regulations and becoming more proactive. As Picketts et al. (2014) state, discussing climate related issues with the community encourages local awareness and can precipitate action.

Much of the community concern for climate change was revealed to be conditional upon the degree of direct impact. In Surrey, for example, turnout for public climate change events was strikingly low, except when these forums took place after a natural hazard, for instance flooding near the open sea. This is consistent with the hypothesis that greater risk perception is associated with greater ecological, human and aesthetic impacts (Willis et al., 2005). If we take, for example, the transtheoretical model for behavior change (Prochaska and Velicer, 1997) individuals might find themselves along a temporal gradient or "stages" regarding their willingness to change or the manner in which they perceive climate change and are willing or not to act upon it, thus changing their behavior.

For example, in North Vancouver and Kootenay Regional Districts, respondents described that behavioral change accelerated once climate change affected the community in an unavoidable way. Attitudes towards water conservation, for example, became positive during droughts, with support for mandatory water restrictions. In Dawson Creek and North Vancouver, community members were engaged to the point of calling with complaints about the 'other side'—those using too much water, or conversely oil and gas supporters who felt threatened by new measures. A recent research on flood-related actions goes further and concludes that experiencing extreme events, rather than risk perception, represents a more significant motivation for the adoption of protective actions and behaviors among Canadians (Thistlethwaite et al., 2018).

Another positive commonality was the idea of change itself as momentum and a social asset. A respondent from T'sou-ke First Nations spoke positively about making a difference with "your own hands," instead of pleading and waiting for others to change. In Dawson Creek, one interviewee noted positively that acts of change might strengthen social networks by bringing people closer. A positive co-benefit of change in Campbell River was described as acting on climate change made people prouder of their community.

A better understanding of these interactions may be helpful for local governments in facilitating deliberations among decision-making groups on climate action policy or developing appropriate climate-related communication materials for community members.

4.2.6.1. Avoiding climate change related terms while focusing on co-benefits  . A significant number of interviewees pointed out that people tend to avoid climate change discussions. Comments from the Kootenay Regional Districts, Dawson Creek, Prince George and West Vancouver revealed that only negative sentiments were associated with the climate change rhetoric, which includes talk of global warming and GHG emissions. Respondents added that climate change rhetoric was seen as too abstract and not motivating. Therefore, local governments were reframing their efforts, both to councilors and staff as well as to the wider community, in terms of the co-benefits that they bring (www.changingtheconversation.ca/capp). Similar outcomes were observed in a study with British local governments, in which 80% of the staff responded that they have enjoyed greatest traction when climate adaptation has been rebranded as weather resiliency (Porter et al., 2015). The authors stated that focusing on weather resiliency has two advantages against the former, avoiding confrontation with climate skeptics and having a better buy-in as it promises to deliver immediate benefits (as adapting to future change seems more remote).

Furthermore, respondents from the present research mentioned that instead of mitigation measures to reduce GHG emissions, their talking points were focused on improvements to the quality of life and health, or the energy conservation and economic benefits. The latter was especially persuasive for implementing more mitigation and adaptation measures in both the public and the private sectors. As an example, the medical journal of B.C. recently published an article promoting active transportation and framed their arguments in terms of the co-benefits, which included the reduction of GHG emissions, fewer pollutant emissions, and a more active lifestyle, in turn preventing chronic disease and poor health (McVea et al., 2017).

4.2.7. Behavioral Change towards climate change

Influencing and changing the behavior of government officials as well as community members proved challenging for all case studies, particularly in communities dependent on extractive industries such as mining, oil, or forestry. In Campbell River, for example, where many have depended for generations on the forestry industry, the population was described as very reluctant to “preserve trees”. Nonetheless, in Prince George, outcomes showed positive sentiments in the way community members were more open to support sustainable initiatives once their basic needs were met. This behavior change is supported and portrayed in Dale et al.’s (2014) community vitality pyramid, depicting the levels or human dimensions and basic needs, having its origins in Maslow’s “hierarchy of needs” (1954).

Several interviewees discussed enforced behavioral change via policy changes (minor but progressive top-down shifts), however, corresponding sentiments were mixed. Enforcing changes and letting people adapt their behavior to the new system was generally described as easier and faster to achieve meaningful change than waiting for the population to change their behaviors. Respondents in Victoria, West Vancouver, and Prince George stated that proactive leadership was crucial, in part because no amount of information can persuade some people to change. Others in Victoria described enforced change as a positive opportunity for creating momentum, stating that quick wins, win-win measures, and the co-benefits of acting can gradually encourage people to be more open to change.

5. Conclusion

Much has been written on the urgent need for change to address the threat posed by climate change, describing the role that varying levels of government have, and their barriers and drivers for planning and implementing climate action initiatives. Less well explored is the manner in which local policy-makers directly involved with climate action feel about these “changes”.

Though usually applied in different domains such as natural language processing and communication research, in this paper we present a new approach to sentiment analysis by identifying the contextual polarity for a subset of sentiment expressions drawn from transcribed interviews conducted with decision-makers based in 11 communities in British Columbia. With this approach, we are able to identify the positive and negative sentiments of the word “change” expressed in regards to climate and the related measures carried out by local governments.

Subsequently, the paper discussed the causes and effects that these sentiments implicate in the 12 most relevant topics in which these expressions were grouped. The analysis revealed that positive sentiments prevailed over negative sentiments, and many diverse examples were given supporting both. Whereas the majority of negative sentiments regarded the insufficiency of the measures implemented, particularly when related to local growth challenges and the long path ahead to reach their GHG reduction goals, the majority of positive sentiments were associated around institutional changes. Among the most optimistic were the responses to integration and collaboration inside local governments, and across their departments, as well as the positive changes in leadership and staff quality.

We argue that it would be fruitful for future studies to reflect on the implications of the present analysis. In this way, it may be possible to target some of the areas where negative changes are taking place and to draw upon experiences in areas where positive changes were expressed. The ideas presented here should contribute to a fruitful ongoing dialogue to further enrich the understanding of the stance of local governments vis-à-vis change and the plausible changes in development paths.

For instance, support and guidance provided by the provincial government was deemed crucial for local government innovation, including the changes prompted by the voluntary Climate Action Charter, providing a more level playing field. Sharing common goals has increased collaboration among municipalities and from external organizations to assist them in resolving a complex-but now common-challenge. However, local governments have tended to focus on small achievements or “easy wins” and measures that focus on co-benefits, thus limiting the scale and pace of change. This has generated frustration among many respondents who regarded the need to change with a sense of urgency, mentioning this was particularly influential at the political level for adaptation and mitigation actions. It also reveals the importance of communicating the urgency of acting now to the both the electorate and elected officials, recognizing that sense of urgency is related to the amount of time people believe we have to act, now or in the longer-term. How can we promote the support of local decision-makers among the diversity of municipalities and the complex politics between the varying levels of government?

The restricted proactivity combined with the limited scope and pace of climate actions are both related to the limited understanding or lack of internalization of the consequences of inaction and differing government priorities. These limitations are further affected by the misalignment of the provincial and federal government goals and policies. Further research is needed to understand the relevance of individual decision-makers regarding climate action and how compliance with GHG emissions reduction goals and coordination can be ensured and transferred to or addressed by higher levels of government.

We hope that this paper stimulates further exchanges among the involved staff and between local governments and that it may foster the co-production of knowledge and enhance climate change policy creation inside local governments.

Declarations of interest

None.

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References

Ackerman, F., 2000. Waste management and climate change. Local Environ. 5 (2), 223–229.
Adger, N.W., Arnell, N.W., Tompkins, E.L., 2005. Successful adaptation to climate change across scales. Glob. Environ. Change Part A 15 (2), 77–86.
Aggarwal, C.C., Zhai, C., 2012. An introduction to text mining. Mining Text Data. Springer, pp. 1–10.
Agrawala, S., Fankhauser, S. (Eds.), 2008. Economic Aspects of Adaptation to Climate Change: Costs, Benefits and Policy Instruments. OECD, Paris 133p.
Bauer, A., Feichtinger, J., Steurer, R., 2012. The governance of climate change adaptation in 10 OECD countries: challenges and approaches. J. Environ. Policy Plan. 14 (3), 279–304.
Baynham, M., Stevens, M., 2014. Are we planning effectively for climate change? An evaluation of official community plans in British Columbia. J. Environ. Plann. Manage. 57, 557–587.
Beck, S., Kuhlicke, C., Görg, C., 2009. Climate Policy Integration, Coherence, and Governance in Germany Helmholtz-Zentrum Für Umweltforschung, UFZ-Bericht 01/2009. 71p.
Becker, G., Aerts, J., Huitema, D., 2013. Influence of flood risk perception and other factors on risk-reducing behaviour: a survey of municipalities along the Rhine. J. Flood Risk Manag. 7, 16–30.
Berke, P., Roenigk, D., Kaiser, E., Burby, R., 1996. Enhancing plan quality: evaluating the role of state planning mandates for natural hazard mitigation. J. Environ. Plan. Manag. 39, 79–96.
Bitz, H., Butler, T., Fletcher, R., McLeod, D., Van der Star, J., 2016. The role of green buildings. Green Building Submission to British Columbia Climate Leadership Plan. 8p.
Botzen, W., Aerts, J., van den Bergh, J., 2009. Willingness of homeowners to mitigate climate risk through insurance. Ecol. Econ. 68, 2265–2277.
Burch, S., 2010. Transforming barriers into enablers of action on climate change: insights from three municipal case studies in British Columbia, Canada. Glob. Environ. Change 20, 287–297.
Burch, S., Shaw, A., Dale, A., Robinson, J., 2014. Triggering transformative change: a development path approach to climate change response in communities. Clim. Policy 14, 467–487.
CAT (Climate Action Tracker), 2018. Climate Action Tracker Country Profile: Canada. Source URL (last Accessed 10 November 2018). https://climateactiontracker.org/countries/canada/.
Cody, E., Reagan, A., Mitchell, L., Dodds, P., Danforth, C., 2015. Climate change sentiment on twitter: an unsolicited public opinion poll. PLoS One 10 (8), e0136092.
Cowell, R., Martin, J., 2003. The joy of joining up: modes of integrating the local government modernisation agenda. Environ. Plann. C Gov. Policy 21 (2), 159–179.
Dale, A., Foon, R., Hebert, Y., Newell, R., 2014. Community Vitality: From Adaptation to Transformation. Fernweh Press, Tatmagouche, Nova Scotia 121p.
Dale, A., Burch, S., Robinson, J., 2017. Multi-level governance of sustainability transitions in Canada: policy alignment, innovation, and evaluation. In: Hughes, S., Chu, E., Mason, S. (Eds.), Climate Change in Cities: Innovations in Multi-Level Governance. Springer.
Doelle, M., 2018. Decades of Climate Policy Failure in Canada: Can We Break the Vicious Cycle? SSRN. 7p.. Source URL (last Accessed 20 November 2018). https://doi.org/10.2139/ssrn.3228743.
Drolet, J., 2012. Climate change, food security, and sustainable development: a study on community-based responses and adaptations in British Columbia, Canada. Community Dev. 43 (5), 630–644.
Dupont, C., 2010. Political Commitment to Climate Policy Integration at EU Level: The Case of Biodiversity Policy. Edinburgh Europa Paper Series 2010/05. 19p.
Dzialek, J., Biernacki, W., Bokwa, A., 2013. Impact of social capital on local communities' response to floods in Southern Poland. Commun. Environ. Disaster Risk Manag. 14, 185–205.
e-Dialogue series, 2018. Biodiversity Conversations. Women for Nature, Nature Canada, and Changing the Conversations. BC, Canada, September 2017 to April 2018. Source URL (last Accessed 25 September 2018). http://changingtheconversation.ca/past-conversations.
Favaro, B., Claar, D., Fox, C., Freshwater, C., Holden, J., Roberts, A., UVic Research Derby, 2014. Trends in extinction risk for imperiled species in Canada. PLoS One 9 (11), e113118.
Fernandez, M., Piccolo, L., Maynard, D., Wippoo, M., Meili, C., Alani, H., 2016. Talking climate change via social media: communication, engagement and behaviour. Proceedings of the 8th ACM Conference on Web Science 85–94.
Ford, J., 2014. Marine mammals of British Columbia. Royal BC Museum Handbook. Victoria, British Columbia. 464p.
Ford, J., King, D., 2013. A framework for examining adaptation readiness. Mitig. Adapt. Strateg. Glob. Change 20, 505–526.
Foxon, T.J., Reed, M.S., Stringer, L.C., 2009. Governing long-term social-ecological change: what can the adaptive management and transition management approaches learn from each other? Environ. Pol. Gov. 19, 3–20.
Füssel, M., 2007. Adaptation planning for climate change: concepts, assessment approaches, and key lessons. Sustain. Sci. 2, 265–275.
Giest, S., Howlett, M., 2013. Multi-level governance and place-based policy-making for climate change adaptation: the European experience and lessons for British Columbia. BC Stud. 176 (133-145), 147–154 199.
Hamin, E., 2011. Integrating adaptation and mitigation in local climate change planning. In: Ingram, G., Hong, Y.-H. (Eds.), Climate Change and Land Policies. Lincoln Institute of Land Policy, Cambridge, MA, pp. 122–143.
Hodson, J., Dale, A., Petersen, B., 2018. The Instagram #climatechange hashtag community: does it impact social capital and community agency? Int. J. Interdiscip. Environ. Stud. 12 (3), 17–35.
Holmberg, K., Hellsten, I., 2014. Analyzing the climate change debate on Twitter: content and differences between genders. Proceedings of the 2014 ACM Conference on Web Science 287–288.
Homsy, G., Warner, M., 2013. Climate change and the co-production of knowledge and policy in Rural USA communities. Sociol. Ruralis 53 (3), 291–310.
IPCC, 2018. Summary for policymakers. In: Masson-Delmotte, V., Zhai, P., Pörtner, H.O., Roberts, D., Skea, J., Shukla, P.R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J.B.R., Chen, Y., Zhou, X., Gomis, M.I., Lonnoy, E., Maycock, T., Tignor, M., Waterfield, T. (Eds.), Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. World Meteorological Organization, Geneva, Switzerland 32p.
IPCC (Intergovernmental Panel on Climate Change), 2007. Climate change 2007: mitigation of climate change. In: Metz, B., Davidson, O.R., Bosch, P.R., Dave, R., Meyer, L.A. (Eds.), Working Group III Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK.
Kennedy, H., 2012. Perspectives on sentiment analysis. J. Broadcast. Electron. Media 56 (4), 435–450.
Kim, S., Hovy, E., 2004. Determining the sentiment of opinions. Proceedings of the International Conference on Computational Linguistics (COLING) 1367–1373.
Kok, M., de Coninck, H., 2007. Widening the scope of policies to address climate change: directions for mainstreaming. Environ. Sci. Policy 10, 587–599.
Korzinski, D., 2018. Bike Lane Divide: Canadians more Likely to Blame Cyclists than Drivers for Conflict on the Roads. 15p. Source URL (last Accessed 28 June 2018). Angus Reid Institute. http://angusreid.org/bike-lanes/.
Lafferty, W., Hovden, E., 2003. Environmental policy integration: towards an analytical framework. Env. Polit. 12 (3), 1–22.
Lechowska, E., 2018. What determines flood risk perception? A review of factors of flood risk perception and relations between its basic elements. Nat. Hazards 26.
Maslow, A., 1954. Motivation and Personality. Harper, New York, NY 369p.
McDaniels, T., Axelrod, L., Cavanagh, N., Slovic, P., 1997. Perception of ecological risk to water environments. Risk Anal. 17, 341–352.
McVea, D., Peterson, E., Lu, J., 2017. How people travel daily from one place to another has significant consequences on their health and the health of their community. BC Med. J. 59 (9), 449 486 COHP.
Mildenberger, M., Howe, P., Lachapelle, E., Stokes, L., Marlon, J., Gravelle, T., 2016. The distribution of climate change public opinion in Canada. PLoS One 11 (8), e0159774.
Moore, A., King, L., Dale, A., Newell, R., 2018. Toward an integrative framework for local development path analysis. Ecol. Soc. 23 (2), 13. https://doi.org/10.5751/ES-10029-230213.
Moser, S., 2016. Reflections on climate change communication research and practice in the second decade of the 21st century: what more is there to say? Wiley Interdiscip. Rev. Clim. Change 7, 345–369.
Mozetič, I., Grčar, M., Smailović, J., 2016. Multilingual twitter sentiment classification: the role of human annotators. PLoS One 11 (5), e0155036.
Newell, R., Dale, A., 2015. Meeting the climate change challenge (MC3): the role of the internet in climate change research dissemination and knowledge mobilization. Environ. Commun. 9 (2), 208–227.
Newell, R., Robinson, J., 2018. Using decomposition methodology to gain a better understanding of progress in and challenges facing regional and local climate action. J. Clean. Prod. 197, 1423–1434.
O'Brien, K., 2015. Political agency: the key to tackling climate change. Science 350 (6265), 1170–1171.
O'Connor, R., Bord, R., Fisher, A., 1999. Risk perceptions, general environmental beliefs, and willingness to address climate change. Risk Anal. 19, 461–471.
Ogneva, M., 2010. How Companies Can Use Sentiment Analysis to Improve Their Business. Source URL (last Accessed 25 September 2018). https://mashable.com/2010/04/19/sentiment-analysis.
Pang, B., Lee, L., 2008. Opinion mining and sentiment analysis. Found. Trends Inf. Retrieval 2 (1–2), 1–135.
Picketts, I., Déry, S., Curry, J., 2014. Incorporating climate change adaptation into local plans. J. Environ. Plan. Manag. 57 (7), 984–1002.
Porter, J., Demeritt, D., Dessai, S., 2015. The right stuff? Informing adaptation to climate change in British local government. Glob. Environ. Change 35, 411–422.
Post, L., Raile, A., Raile, D., 2010. Defining political will. Polit. Policy 38 (4), 653–676.
Price, K., Daust, D., 2016. Climate Change Vulnerability of BC's Fish and Wildlife: First Approximation. BC Ministry of Forests, Lands, and Natural Resource Operations, B.C 41p.
Prochaska, J., Velicer, W., 1997. The transtheoretical model of health behavior change. Am. J. Health Promot. 12, 38–48.
Ruparathna, R., Hewage, K., Sadiq, R., 2017. Rethinking investment planning and optimizing net zero emission Buildings. Clean Technol. Environ. Policy 19, 1711–1724.

Rutherford, S., 2009. Bill 27: Opportunities and Strategies for Green Action by BC Local Governments. West Coast Environmental Law Research Foundation, Vancouver, Canada 20p.
Scharl, A., Herring, D., Rafelsberger, W., Hubmann-Haidvogel, A., Kamolov, R., Fischl, D., Fols, M., Weichselbraun, A., 2015. Semantic systems and visual tools to support environmental communication. IEEE Syst. J. 11 (2), 762–771.
Semenza, J., Hall, D., Wilson, D., Bontempo, B., Sailor, D., George, L., 2008. Public perception of climate change: voluntary mitigation and barriers to behavior change. Am. J. Prev. Med. 35, 479–487.
Shaw, A., Burch, S., Kristensen, F., Robinson, J., Dale, A., 2014. Accelerating the sustainability transition: exploring synergies between adaptation and mitigation in British Columbian communities. Glob. Environ. Change 25, 41–51.
Sluban, B., Smailović, J., Juršič, M., Mozetič, I., Battiston, S., 2014. Community sentiment on environmental topics in social networks. Proceeding of the Tenth International Conference on Signal-Image Technology & Internet-Based Systems 376–382.
Sluban, B., Smailović, J., Battiston, S., Mozetič, I., 2015. Sentiment leaning of influential communities in social networks. Comput. Soc. Netw. 2 (9), 21.
Smith, E., Mayer, A., 2018. A social trap for the climate? Collective action, trust and climate change risk perception in 35 countries. Glob. Environ. Change 49, 140–153.
Stern, P., 2000. Towards a coherent theory of environmentally significant behavior. J. Soc. Issues 56, 407–424.
Stoddart, M., Haluza-DeLay, R., Tindall, D., 2016. Canadian news media coverage of climate change: historical trajectories, dominant frames, and international comparisons. Soc. Nat. Resour. 29 (2), 218–232.
Tang, Z., Brody, S., Quinn, C., Chang, L., Wei, T., 2010. Moving from agenda to action: evaluating local climate change action plans. J. Environ. Plan. Manag. 53 (1), 41–62.
Thelwall, M., Buckley, K., Paltoglou, G., 2011. Sentiment in Twitter events. J. Am. Soc. Inf. Sci. Technol. 62 (2), 406–418.
Thistlethwaite, J., Henstra, D., Brown, C., Scott, D., 2018. How flood experience and risk perception influences protective actions and behaviours among Canadian homeowners. Environ. Manag. 61, 197–208.
UNFCCC, 2015. Adoption of the Paris Agreement. Report No. FCCC/CP/2015/L.9/Rev.1. Source URL (last Accessed 10 November 2018). http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf.
Vogel, B., Henstra, D., 2015. Studying local climate adaptation: a heuristic research framework for comparative policy analysis. Glob. Environ. Change 31, 110–120.
Wachinger, G., Renn, O., Begg, C., Kuhlicke, C., 2013. The risk perception Paradox - Implications for governance and communication of natural hazards. Risk Anal. 33, 1049–1065.
Weichselbraun, A., Scharl, A., Gindl, S., 2016. Extracting opinion targets from environmental web coverage and social media streams. Proceedings of the 49th Hawaii International Conference on System Sciences. pp. 1040–1048.
Willis, H., DeKay, M., Fischhoff, B., Morgan, M., 2005. Aggregate, disaggregate, and hybrid analyses of ecological risk perceptions. Risk Anal. 25, 405–428.
Wright, C., Hogue, R., 2018. Housing Trends and Affordability. September 2018. 10p. Source URL (last Accessed 10 November 2018). Royal Bank of Canada (RBC) Economics. http://www.rbc.com/economics/economic-reports/pdf/canadian-housing/house-sep2018.pdf.
Wu, X., Ramesh, M., Howlett, M., Fritzen, S., 2018. The Public Policy Primer: Managing the Policy Process. Routledge, London/ New York.
Yin, R., 2003. Case Study Research: Design and Methods, 3rd ed. Sage, Thousand Oaks, CA 181p.
Yohe, G., Lasco, R., Ahmad, Q., Arnell, N., Cohen, S., Hope, C., Janetos, A., Perez, R., 2007. Perspectives on climate change and sustainability. In: Parry, M., Canziani, O., Palutikof, J., van der Linden, P., Hanson, C. (Eds.), Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, pp. 811–841.